THE PORTLAND STONE.

This formation, as well as the Purbeck stone and Sussex marble, to be hereafter described, although generally ranked in the upper part of the oolitic series, have been separated from the true oolites for the sake of simplicity, and because they are not continuous, like the ranges of the middle and lower oolite, but are confined to particular districts, or feebly represented in other parts of England by rocks whose constituents are widely different. Thus the calcareous beds of the Isle of Portland, to which the name of Portland stone is confined, do not appear in any other part of England, except in the vale of Aylesbury, where they are not worked to any great extent. The Kimmeridge clay, however, which represents part of the Portland formation, namely, the clay on the north side of the island which underlies the Portland stone, is met with in the vale of Pickering: it also borders the chalk and lower green sand of Lincolnshire, and with the Portland oolite already mentioned, fills a considerable breadth in the vale of Aylesbury. Capped occasionally by irregular patches of oolite, the clay goes on following and underlying the green sand of Oxfordshire, Berkshire, and Wiltshire, where it disappears near Wincaunton. It appears again under the South Downs of Dorsetshire, and in the Isle of Portland, where it is overlaid by that great mass of oolite so well known under the name of Portland stone.

There are no less than fifty-six quarries in the isle of Portland, and the stone produced from them may be divided into three distinct varieties, namely the *cap*, the roach-stone, and the freestone beds in common use for architectural purposes. The *cap* occurs in one or more beds of whitish cream-coloured very hard limestone, with partings of clay, and generally occupies a thickness varying in different quarries from 5 to 12 feet. This stone is seldom used for building purposes, but is extensively burnt for lime.

The roach beds are very peculiar in their structure and appearance, being almost entirely made up of the casts of molluscous animals, both univalve and bivalve, united by an earthy and sometimes slightly crystalline cement. The material of the shell in this stone has been generally destroyed, so that there is a hollow left between the casts and the matrix in which they are embedded. This gives rise to a very peculiar appearance in the stone, which is not deficient in strength, but is seldom used for the exposed faces or parts of buildings. The roach is usually about 2 to 4 feet thick, although in some of the quarries the roach-stone replaces one of the beds of freestone; in which case it sometimes reaches ten feet in thickness. The freestone beds are a light cream colour, fine grained, generally with an oviform structure, mostly fossiliferous, the cement of the stone being semi-crystalline in the best specimens, and in others somewhat earthy, and decomposing much faster than the imbedded fossil shells, which are seen in some buildings standing out in relief. The thickness of the freestone beds is generally from 7 to 10 feet. The cost of the best stone at all the quarries in 1839 was 1s. 4½d. per cubic foot and about 2s. 3d. in London.

No. 180 contained specimens of Portland stone dressed in a variety of ways, and showing its applicability to ornamental carving. The roach stone is dressed with hollows to imitate rock-work, so that the natural hollows in the stone do not appear as a blemish, but rather as intentional and ornamental. There are several ingenious contrivances for dressing this stone in such a way as to neutralise the unsightly appearance of the hollows; such, for instance, as representing the stems of ivy climbing up a wall, and producing other varieties of rugged surface.

No. 160 contained numerous specimens of the Portland freestone of a light cream colour, fine grain, and compact structure. These represent the material used in the Royal Mint, the Bank of England, British Museum, Fishmongers' Hall, Bethlehem Hospital, and Bridgewater House, among modern buildings: The employment of Portland stone in St. Paul's Cathedral, the Monument, Westminster and Blackfriars Bridges, the Horse Guards, and nearly all the metropolitan buildings of corresponding age is well known.

No. 160 also contained a specimen of roach stone from the Portland quarries. This stone contains numerous casts of fossils, with hollows between the casts and the matrix; the part surrounding the hollow being hard and semi-crystalline. In some cases the substance of bivalve shells is left. These are frequently large species of oyster or mytilus, and probably serve to strengthen the stone. The specimen has a dingy cream colour, and represents the stone used in the piers of Blackfriars-bridge, Dover-pier, Weymouth-bridge, &c.

No. 173 and No. 193 exhibited specimens of Portland stone from the freestone beds, about which there is nothing particular to notice.

Although this stone has been a general favourite for many years, it seems now to be less thought of. No doubt a great deal of the modern prejudice against it has arisen from the deception practised by parties connected with the quarries, and the neglect of care in selection. The stone from Waycroft Hall quarries, on the east side of the island, was used for Goldsmiths' Hall, the Reform Club-house, and some other buildings of note; whilst no one can doubt for a moment that the Grove Quarries at Redcroft and Bowers, which supplied the stone for St. Paul's Cathedral, and many other metropolitan churches, are still capable of yielding good stone. To show however with what care and judgment the particular beds should be selected, it has been found that the upper bed of freestone is the best in some quarries and the worst in others. The present condition of St. Paul's Cathedral is exceedingly good, the carvings of flowers, fruit, and other ornaments, although blackened, being as perfect as when first executed. In fact, the black appearance of the stone is a sure indication that no decay is in progress; whereas, when the Portland stone looks white, the appearance is probably caused by slight decomposition of the surface.

The weight of the Portland stone varies from 135 to 147 lbs. per cubic foot, and the stone from Waycroft was particularly examined by the Royal Commissioners in 1839. It consists of 95 per cent. of carbonate of lime, being a larger proportion than any other stone which they analyzed: the other principal mineral ingredients were silica and carbonate of magnesia, of each 1·20 per cent. The disintegration of this stone was only 1 grain in 1,600, being very much less than in any other limestone that was tried.

THE PURBECK STONE.

This formation overlies the Kimmeridge clay in the Isle of Purbeck, and probably overlies and conceals the Portland oolite there. It also appears at Chickagrove, in Wiltshire, filling up the Vale of Nidder towards Salisbury. It consists of various beds of stone ranging in colour from a light cream to a very dark grey, and sometimes a brown, several beds being used for flag pavement, others being freestone used as ashlar, alternating with inferior beds of stone, clay, &c.

The principal quarries in the Isle of Purbeck are in the neighbourhood of Swanage, where the stone is shipped in large quantities.

No. 160 contained several specimens of Purbeck stone from the Swanage quarries, namely, a whitish cream-coloured stone, with a slightly oolitic structure from the Purbeck Portland quarry at Swanage. This is the upper bed, and is used for troughs, sinks, and steps. This stone has been employed for the lighthouse at Margate, the clock-house of Dover Pier, the prison at Winchester, the West India Docks in London, the lighthouse at the Isle of Wight, the obelisk at Encombe Park, and numerous churches, bridges, &c., in the neighbourhood. Weight per cubic foot, 151 lbs. Price in London, 1s. 9½d. per cubic foot. A block, from the third bed from the top in Swanage quarries is also a whitish cream-coloured stone, not so oolitic as the last, and with somewhat more crystalline structure, owing to the abundance of fossil shells, frequently intersected by narrow fissures filled with pure carbonate of lime about one-eighth of an inch wide. Specimen from Swanage Downs-vein, being the fourth vein from the top, a very light greyish stone used for paving. Block from Swanage Quarries, being the fifth vein from the top, a dull brownish grey-coloured stone, containing probably more alumine than some of the former varieties, moderately fossiliferous, intersected in many directions with very minute cracks filled with crystallized lime. This stone is much used for ashlar, and for the curbs of foot pavement. Specimen from the fifth bed, sixth vein from the top in Swanage quarry, a compact greyish limestone, very fossiliferous, used for paving, steps, and ashlar. Block from Feather Quarry, Swanage, a darkish grey-coloured limestone, very fossiliferous, used for ashlar, curbstones, steps, &c. Specimen from Leaning vein, the next below the Purbeck marble, a cream-coloured, very compact, fossiliferous, and moderately crystalline stone used chiefly for pavements, curbstones, and steps.

No. 160 and No. 193, contained specimens of Purbeck marble, a dark grey-coloured limestone, almost entirely composed of univalve shells of the genus Paludina, cemented together with an argillo-calcareous basis. This stone takes a beautiful polish, and was formerly much used for slender columns and shafts in our cathedral churches, few of which, in the south of England, are without specimens of this marble. Even now it is used for hall and library tables, slabs, mantel-pieces, &c., the sections of the shells on the polished surface being very ornamental, and sometimes grotesquely fanciful.

No. 193 contained one or two other specimens of Purbeck building stone, which do not differ from those already described.

No. 135 contained a very handsome block of Purbeck marble 4 feet long and 18 inches square, polished on several of its sides. This specimen was from Woodyhide, near Corfe Castle, and was used in decorating the interior of the Temple Church.

No. 202 contained two specimens of Purbeck stone from Chickagrove, near Tisbury, Wilts. These are both of a whitish cream colour, fine grained, and are much harder than the other. The hard variety is used for steps, pavements, monuments, tablets, &c., and occasionally for troughs. The soft is used for fronts of houses, cornices, and general building purposes.

No. 152 contained a specimen of Sussex marble which very closely resembles the Purbeck marble, except that the prevailing fossil is usually a larger species of Paludina than in the Purbeck. Beds of Sussex marble, seldom exceeding a foot in thickness, range for long distances in nearly parallel courses throughout the weald of Kent and Sussex, and the variety called the Petworth marble is almost as well known and as extensively used as the Purbeck marble. The wealden beds of Kent and Sussex are supposed to occupy geologically a higher place in the oolitic series than the Purbeck oolites. The wealden formation of Kent and Sussex, consisting, in its upper part, of a thick mass of bluish clay, called by the older geologists the oak-tree clay, and in its lower part consisting chiefly of arenaceous beds, contains few building stones of much consequence. A species of very shelly limestone, termed Sussex marble, much resembling the Purbeck marble, occurs at Petworth, and numerous other places in the weald clay chiefly in thin beds a few inches in thickness. In the arenaceous part of the formation as at Horsham, Hastings, and Tilgate Forest, beds of sandstone occur suitable for building, and occasionally flag stones are met with. Ironstone is disseminated throughout the lower part of the wealden formation in the shape of irregular concretions, and also in laminated buff-coloured beds.

No. 50 contained specimens of a white siliceous stone termed locally Hastings granite. This is a mere stratified aggregation of pure siliceous particles, with a calcareous cement, and bears no resemblance whatever to granite. It also contained a specimen of grey calcareous rock from Tilgate Forest, which is used for a building stone at Hastings, and particularly in the new houses at St. Leonard's.

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